

Research on Adaptive Dust Detection Machine Based on Reinforcement Learning

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Abstract: In order to better improve the quality of dust detection, to save the cost, the economic research in the traditional dust testing machine as the carrier, the Internet of things, artificial intelligence, reinforcement learning, such as technology, introduced a set of adaptive dust detection machine system based on reinforcement learning, realize the dust continuous monitoring, and achieve accurate warning when dust exceeds the threshold, and automatically stop the machine operation.

Keywords: Reinforcement learning; Adaptive; Dust detection system

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1. Introduction

With the development of modern society, the emergence of various factories has brought great convenience to people's life, but also brought more serious environmental problems. Many factories will produce a large number of harmful gases and dust in their daily operation. If they are discharged into the atmosphere without strict treatment, they will cause great harm to human beings. Plant operation is inevitable, but dust concentration detection has become one of the main tasks during operation. Reinforcement learning is one of the most active fields in artificial intelligence. Reinforcement learning is a computational method of learning in which an agent tries to maximize reward when interacting with a complex and uncertain environment. The biggest advantage of reinforcement learning is that it can be learned in normal operations, while traditional deep learning methods require training with labeled data sets. Dust detection and monitoring management can effectively protect the environment. Therefore, it is very important to monitor dust concentration.

2. Principle of researching

This project mainly uses the model of reinforcement learning to process, analyze and integrate data, and finally judge the current state, and display it on the client, and realize automatic machine stop in case of damage. Using the dust concentration in the sensing module acquisition environment, using reinforcement learning technology data training model building and forecasting, monitoring is realized by the client in real-time space dust concentration condition, according to the result of the analysis of the reinforcement learning and damaged warning, finally realizes the environmental dust concentration is too high, the production machine automatically stops running^[1].

3. Reinforcement learning model

Reinforcement learning can also be understood as online learning. The basic model of reinforcement learning is shown in Figure 1 below. Reinforcement learning is essentially a process of "test, assessment, feedback, more test" of the cycle, learning system (also referred to as agent) must first perceive environmental information, and in the environment an action, when I received from the environmental movement and change, to change the feedback at the same time to the study of a feedback (rewards or penalties). An agent makes a decision based on the current state and the rewards it receives; The principle is to get bigger returns in the future.

Reinforcement learning can also be understood as online learning. The basic model of reinforcement learning is shown in Figure 1 below. Reinforcement learning is developed on the basis of many related disciplines, including psychology, control theory, statistics, etc. In the 20th century in the late eighties and nineties, the reinforcement learning of mathematics basic research obtained the breakthrough, and then after years of development, reinforcement learning has become the current human for solving sequential optimization decision-making problems is an effective way, in areas such as machine learning, artificial intelligence, automatic control in a wide range of applications. An agent makes a decision based on the current state and the rewards it receives; The principle is to get bigger returns in the future.

4. Design of hardware of dust detection machine

4.1 System hardware design

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The system consists of main circuit, key, alarm, signal equipment, display unit and protection device. Among them, Gp2y101010op is the dust concentration collection device, the MCU is the main control circuit, mainly responsible for information processing and control; Key for information input device; The protection is a fan and an electric spray. Display device is LCD1602; Alarm device is three-color LED and buzzer.

4.2 The sensing module

The static charge sensor of a fixed probe is used to generate static charge induced by the dust particle probe, and the signal is amplified to the monitoring and control system through the probe. The size of static charge is proportional to the flow rate of dust particles. Through the electronic circuit, the control center is used to convert this part of charge into control signal output, start dust discharge high diameter exceeding standard, and record dust concentration exceeding standard.

5. Design of dust detection machine software

5.1 System client design

The main tasks of the client include: (1) receiving the data forwarded by the data processing unit; (2) Parse the received data according to the communication protocol. The client consists of a local client and a mobile client. Without networking, the local client can directly read the data obtained by the intensive learning analysis of the data analysis unit for parsing and display. The mobile client part is a desktop client software based on PC-Windows platform, using Winsock programming interface as network programming, select model to complete TCP/IP communication. First, initialize the socket set and send a connection request to the server using the connect function. After a successful connection, listen for data sent by the server. Analyze and display the data.

5.2 Design of system operation principle

When the dust concentration does not exceed the set value, the p2.0 terminal of the microcontroller emits a low level and the green diode lights up, indicating that the dust concentration is normal. When the concentration is higher than the set value, the terminal of P2.1 gives a low level, and the yellow diode lights up, which means that the concentration is moderate. P2.2 is low level, and the three are saturated, the collector is high potential, the relay pole is energized, and the contact is pulled in. Relay terminals 1 and 2 are connected to the fan in terminals 1 and 2, and the fan runs to reduce dust. Conversely, when P2.4 is at high voltage, the triode interrupts, the collector is at low potential, the relay pole is closed, and the fan connected to terminals 1 and 2 cannot be connected. When the dust concentration is higher than the maximum value, the p2.2 terminal emits a low level, the red diode lights up, and the door rings, indicating that the dust concentration is very high. The levels of P2.3 and P2.4 are low, the three are saturated, the collector is high potential, the relay pole generates energy, and the fan rotates and sprays water to reduce the dust concentration.

5.3 Design the whole system operation process

The system adopts sound and light alarm, yellow LED means medium, red LED means excessive, green LED means safe. When the concentration exceeds a set maximum limit, an alarm is sounded. In the meantime, various protective measures have been taken. If the dust concentration does not exceed the limit value, the relay will be controlled for ventilation to avoid too high concentration. When the dust concentration is too high, at the same time of ventilation, the relay control fixed point spray, play a double protection role, reduce the dust concentration. In the case of high value for a long time, connection ports can be reserved at both ends of the power supply to connect the low-flow fan and start operation to reduce dust concentration. The microcontroller displays the actual dust concentration on the LCD1602 screen and compares it with the determined dust concentration.

6. Conclusion

With the further development of industrialization, air pollution has become one of the key problems to be solved. Dust mainly refers to solid particles in the air. Dust is a key index to determine the quality of control, and particles with a diameter of less than 10 μ m can even directly enter the human respiratory tract, alveoli, resulting in cardiovascular diseases, heart and lung diseases. Dust acts as a carrier of bacteria and can easily spread disease in the air. Due to the nature of work, some factories even contain toxic substances in dust. If people stay in this environment for a long time, toxic substances will enter human respiratory tract or contact skin, resulting in cancer and other serious threats to human health^[2]. Through reinforcement learning based adaptive dust detection machines, prompting the practicality of the thesis is more significant, it has important effect on the practical application of the thesis, from the macroscopic and microscopic research integration promote research on the basis of scientific and reasonable level, so the introduction of reinforcement learning thought to analyze dust testing machine, it can deal with dust detection problems more effectively.

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